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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/788,539

Applicant(s)

LING, XINSHENG SEAN

Examiner

NARAYAN K. BHAT

Art Unit

1634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) 17-21 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 13-16 is/are allowed.
- 6) ☒ Claim(s) 1-12, 22 and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/S508)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. This office action is written in reply to applicant's correspondence filed November 24, 2008. Claims 1, 12, 13, 17, 20, 22 and 23 were amended. Applicant's amendments requiring integral substrate member having a thickness and first and second opposing surfaces and pore extending through said substrate member from said first surface to said second surface is constructed to have dimensions suitable for transversely passing one or more biomolecules necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.**
2. Claims 1-23 are pending in this application.
3. Claims 17-21 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention of group II there being no allowable generic or linking claim in the reply filed on February 21, 2008.
4. Claims 1-16, 22 and 23 are under prosecution.

Claim Objections

5. Previous objection to claim 12 was withdrawn in view of correcting the typographical error.

Claim Rejections - 35 USC § 112

6. Previous rejections of claims 13-16, 22 and 23 were withdrawn in view of claim amendments.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1-9, 12 and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Golovchenko et al (USPN 6,464,842 issued Oct. 15, 2002, cited in the IDS filed on 2/27/2004) in view of Coles (USPN 5,314,829 issued May 24, 1994) and further in view of Deamer (USPN 6,428,959 issued Aug. 6, 2002).

Regarding claim 1, Golovchenko et al teaches a process to fabricate pores comprising the steps of: providing an integral substrate member having a thickness (Fig. 1A, # 10, column 5, lines 14-19) and a first (Fig. 1A, # 14) and a second opposing surfaces (Fig. 1A, # 18, column 5, lines 19-25). Golovchenko et al also teaches forming at least one cavity (i.e., channel) lengthwise in a first direction in first surface (Fig. 1A, # 12, column 5, lines 19-21) and further teaches thinning the second surface and decrease the thinning corresponding cavity side wall (column 5, lines 51-57, for details see column 8 and 9), which is reasonably interpreted as forming at least one cavity (i.e., channel) length wise in the second direction being disposed at an angle relative to the first direction.

Golovchenko et al also teaches that the first cavity and second cavity extend inwardly from first and second surfaces and intersect at a point, defining an aperture

(i.e., pore) extending through the substrate member from the first surface to the second surface (Fig. 1D, # 24, column 5, lines 40-45). Golovchenko et al further teaches that the apertures of pre-specified diameter are suitable for applications in biology field (Figs. 5 and 7, column 3, lines 5-9 and 49-54). Golovchenko et al also teaches that the aperture sizes can be enlarged or reduced and comprises a slot or gap or trench structure (column 2, lines 40-44), but are silent about V-shaped channel on the surface and pores have dimensions suitable for transversely passing one or more biomolecules.

Regarding claims 2 to 4, Golovchenko et al are silent about forming a plurality of channels on the first and second surface.

Regarding claim 5, Golovchenko et al teaches that the substrate member is silicon, plastic (column 6, lines 1-10).

Regarding claim 6, Golovchenko et al teaches that the substrate member has a surface layer comprising silicon nitride or silicon dioxide (column 6, lines 30-35).

Regarding claim 7, Golovchenko et al teaches that the steps of forming first and second channels are by etching (column 2, lines 25-30).

Regarding claim 8, Golovchenko et al teaches that the aperture (i.e., pore) has width of a 95 nm, which is between about one nanometer and 100 micrometer as claimed (column 3, Fig. 7A, column 4, lines 24-25).

Regarding claim 9, Golovchenko et al teaches that aperture is electrically addressable (column 15, lines 32-37).

Regarding claim 12, Golovchenko et al teaches oxidizing the substrate member and heating the substrate member adjacent to aperture thereby reducing the size of the

pore, monitoring change in the size of the aperture using electronic feedback loop and stopping heating when the size of the pore is reduced to predetermined size (Example 3, Fig. 3, column 9, lines 63-67 and column 10, lines 1-63; Fig. 7A and 7B, compare size of the aperture reduced from 95-nm to a predetermined size of 3 nm).

Regarding claim 22, Golovchenko et al teaches the aperture has a width of submicron, which is reasonably interpreted as larger than 100 nm, thus teaching an aperture is a micropore as defined in the instant claim.

Regarding claim 23, Golovchenko et al teaches that the aperture is 95 nm width, which is less than 100 nanometers (Fig. 7A), thus teaching an aperture is a nanopore as defined in the instant claim.

As described above, regarding claims 1-4, Golovchenko et al teaches cavities or trenches or slots on the first and second surface but are silent about V-shaped channels and a plurality of V-shaped channels on the substrate. However, a plurality of V-shaped channels on the substrate were known in the art at the time of the claimed invention was made as taught by Coles, who teaches a substrate (Fig. 1, # 10) with 1000 grooves, i.e., channels per die (Fig. 1, Groove # 30, Die # 15, column 3, lines 10-15) and further teaches each channel is V-shaped (Fig. 2, column 3, lines 21-22). Coles also teaches that the V-shaped channels formed on the substrate are parallel (Fig. 1, # 20). The combined teachings of Golovchenko et al and Coles would provide a plurality of V-shaped channels on the first surface and a plurality of V-shaped channels on the second surface and wherein plurality of first V-shaped channels and a plurality of second V-shaped channels intersect at an array of points defining an array of pores

extending through substrate from the first surface to the second surface. Coles also teaches that the V-shaped channels allows biomolecules slide easily in the channel and well suited for scanning by atomic microscope for real time data analysis (column 4, lines 8-10 and 25-28).

It would have been prima facie obvious to one having the ordinary skill in the art at the time the invention was made to modify the channel shape on the surface of the substrate in the method of Golovchenko et al with the V-shaped channels on the surface of Coles with a reasonable expectation of success.

An artisan would have been motivated to modify the channel shape on the surface of the substrate in the method of Golovchenko et al with the expected benefit of sliding biomolecules easily into channel for easy scanning by atomic microscope for real time data analysis as taught by Coles (column 4, lines 8-10 and 25-28).

Golovchenko et al also teaches that the apertures of pre-specified diameter are suitable for applications in biology field (Figs. 5 and 7, column 3, lines 5-9 and 49-54). Golovchenko et al and Coles are silent about pores have dimensions suitable for transversely passing one or more biomolecules. However, transversely passing biomolecules through the pore was known in the art at the time of the claimed invention was made as taught by Deamer.

Deamer teaches a method for detecting biomolecules comprising transversely passing of fluid sample comprising single and double stranded DNA (i.e., biomolecules) through a nanopore and detecting the DNA type in the sample (Fig. 2, column 1, lines 64-67 and column 2, lines 1-4). Deamer also teaches that biomolecule detection using

nanopores distinguishes single stranded DNA from double stranded DNA easily and does not require any labels (column 1, lines 51-55, column 5, lines 54-67).

It would have been *prima facie* obvious to one having the ordinary skill in the art at the time the invention was made to modify the aperture testing method of Golovchenko et al and Coles with the biomolecule translocation through the nanopore method of Deamer with a reasonable expectation of success.

An artisan would have been motivated to modify the aperture testing method of Golovchenko et al and Coles with the expected benefit of distinguishing single stranded DNA from double stranded DNA easily without any labels as taught by Deamer (column 1, lines 51-55, column 5, lines 54-67), thus providing specific utilities in the field of biology as envisioned by Golovchenko et al.

9. Claims 1-3 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Golovchenko et al (USPN 6,464,842 issued Oct. 15, 2002), (USPN 5,314,829 issued May 24, 1994) and Deamer (USPN 6,428,959 issued Aug. 6, 2002) as applied to claims 1-3 above and further in view of Fritsch et al (USPGPUB NO. 2002/0058279 published May 16, 2002).

Claims 10 and 11 are dependent from claims 2 and 3 respectively. Claims 2, 3 are dependent from claim 1. The teachings of Golovchenko et al, Coles and Deamer with regard to claims 1-3 are described in this office action in section 8.

Regarding claims 10 and 11, Golovchenko et al teaches an array of apertures (i.e., pores, column 2, lines 37-39) and further teaches each aperture has electrodes for

the feedback control (column 15, lines 32-46). Coles also teaches capacitor plates on the side of the die to apply electric field to the channel (column 4, lines 15-19). Deamer also teaches electrodes adjacent to the nanopore (Fig. 2). Golovchenko et al, Coles and Deamer are silent about array of pores are individually electrically addressable.

However, individually electrically addressable array of pores was known in the art at the time of the claimed invention was made as taught by Fritsch et al who teaches method for fabrication pores comprising array of pores (Fig. 5) and further teaches that each pore includes independently addressable electrodes (Fig. 6, Fritsch et al, claim 4). Fritsch et al also teaches individually addressable electrodes as integral component of the pore makes them an excellent self-contained analysis unit in small volumes (paragraph 0021). The combined teachings of Golovchenko et al, Coles and Deamer and Fritsch et al would provide individually electrically addressable array of pores.

It would have been prima facie obvious to one having the ordinary skill in the art at the time the invention was made to modify the pore fabrication method of Golovchenko et al, Coles and Deamer with the method of fabricating individually electrically addressable electrodes as integral component of the pore of Fritsch et al with a reasonable expectation of success.

An artisan would have been motivated to modify the pore fabrication method of Golovchenko et al, Coles and Deamer with the expected benefit of making individually electrically addressable electrodes as integral component of the pore as an excellent self-contained analysis unit in small volumes as taught by Fritsch et al (paragraph 0021).

10. It appears that the subject matter of claims 13-16 is free and clear of prior art of record.

Response to remarks from the Applicants

Rejections under 35 U.S.C. § 103(a)

11. Applicant's arguments with respect to claim 1-8 and 23 filed on November 24, 2008 being unpatentable over Fleming in view of Coles have been considered (Remarks, pgs. 7-11) but are moot in view of the withdrawal of the rejections and new grounds of rejection as set forth in this office action necessitated by claim amendments.

Applicant's arguments regarding teachings of Coles are not persuasive because they are directed towards not curing the deficiency of teachings of Fleming (Remarks, pg. 9, paragraph 4, pg. 10, paragraphs 1 and 2) and in view of withdrawal of the rejections by Fleming in view of Coles.

Applicant's arguments with respect to claims 1-3 and 9-11 being unpatentable over Fleming, Coles and Fritsch are moot because they are directed towards not curing the deficiency of teachings of Fleming and Coles (Remarks, pg. 11, paragraph 2) and Applicants have not traversed the teachings and suggestions and motivation of Fritsch and in view of withdrawal of said rejection.

Applicant's arguments with respect to claims 1, 12 and 22 being unpatentable over Fleming, Coles and Storm et al are moot because they are directed towards not curing the deficiency of teachings of Fleming and Coles (Remarks, pg. 11, paragraph 3)

and Applicants have not traversed the teachings and suggestions and motivation of Storm et al and in view of withdrawal of said rejection.

Conclusion

12. Claims 1-12 and 22-23 are not allowed.
13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Narayan K. Bhat whose telephone number is (571)-272-5540. The examiner can normally be reached on 8.30 am to 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ram R. Shukla can be reached on (571)-272-0735. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Narayan K. Bhat/

Examiner, Art Unit 1634

/Ram R. Shukla/

Supervisory Patent Examiner, Art Unit 1634